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The 1993 Annual Report of
The Monitoring Avian Productivity and Survivorship
(MAPS) Program on the Flathead National Forest

THE 1993 ANNUAL REPORT OF
THE MONITORING AVIAN PRODUCTIVITY AND SURVIVORSHIP (MAPS) PROGRAM
ON THE FLATHEAD NATIONAL FOREST

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SUMMARY

The Monitoring Avian Productivity and Survivorship (MAPS) program, coordinated by The Institute for Bird Populations, is a cooperative effort among public and private agencies and individual bird banders in North America to operate a continent-wide network of constant-effort mist-netting and banding stations. One major purpose of the MAPS program is to provide annual regional indices and estimates of adult population size, post-fledging productivity, adult survivorship, and recruitment into the adult population for various landbird species. Data on productivity and survivorship are not provided by any other avian monitoring program in North America and are needed to provide crucial information upon which to initiate research and management actions to reverse the recently documented population declines of North American landbirds. The system of national forests may provide one group of ideal locations for this large-scale long-term biomonitoring because they provide large areas of breeding habitat for neotropical migratory landbirds that are subject to varying management practices.

A second objective of the MAPS program is to provide standardized population and demographic data for the landbirds found on federally managed public lands, such as the national forests, national parks, and military installations. In this vein, it is expected that population and demographic data on the landbirds found in any given forest can aid research and management efforts within the forest to protect and enhance the forest's avifauna and ecological integrity while allowing the forest to serve its multi-use purposes.

In light of these objectives, six MAPS station were established in 1992 on or immediately adjacent to the Flathead National Forest. Four of the stations were located on the Flathead National Forest (one in the Coram Experimental Forest, one in the Swan River Research Natural Area and two in the forest proper). One of the remaining two stations was located on The Nature Conservancy's Swan Oxbow Preserve while the other station was located on land owned by the Plum Creek Timber Company. Ten 12-m, 30-mm-mesh mist nets were established at each station and each station was operated in a constant-effort manner for six morning hours per day, for one day per 10-day period, and for eight consecutive 10-day periods between June 10 and August 28 in both 1992 and 1993. A series of nine 10-minute point counts was also conducted three times at each of the six stations, once during each of the first three 10-day periods that the station was operated in each year. Finally, habitat maps showing the major vegetation types were created and the vegetation in each habitat type was semi-quantitatively described each year.

A total of 494 birds of 44 species was banded at the six stations on the Flathead National Forest during the summer of 1993, and various individuals were recaptured a total of 156 times. Another 47 birds (mostly hummingbirds) were captured but were released unbanded; thus, a total of 697 captures of 49 species was recorded. As in 1992, the capture rates of adult birds (an index of adult population size) were higher at the four stations that included substantial meadow or riparian habitat and lower at the two stations that generally lacked such habitat. The fact that these patterns were consistent in two consecutive years having notably different weather suggests that these patterns may be real and that the MAPS protocol is capable of revealing these patterns very well. Indices of adult population size derived from capture data were significantly correlated with indices of adult population size derived from point-count data at all six of the stations, indicating that the arrays of mist nets at these stations effectively sampled adult birds in proportion to their abundance, at

least in proportion to their abundance as determined by point counts.

Using constant-effort data, the capture rate of adult birds of all species pooled decreased significantly ($P < 0.01$) by 23.0% from 1992 to 1993 for all six stations combined and independently decreased for 28 of 44 species ($P < 0.05$). Moreover, adult population sizes for all species pooled independently decreased at each of the six stations by amounts ranging from 7% to 35%, although the decrease at only one station was significant. We suggest that these substantial decreases in adult population size were caused primarily by the heavy and late-melting snowpack of 1993 that decreased the recruitment of breeding birds in 1993, and secondarily by low productivity in 1992. The capture rate of young birds of all species pooled also decreased significantly ($P < 0.001$) by 55.9% from 1992 to 1993 for all six stations combined and independently decreased for 30 of 37 species ($P < 0.001$). Moreover, the capture rate of young for all species pooled independently decreased at each of the six stations by amounts ranging from 30% to 70%, although the decreases at only two stations were significant. The percentage of young in the catch for all species pooled also decreased significantly ($P < 0.05$) by 33% of the 1992 value for all stations combined and independently decreased for 21 of 34 species ($P = 0.115$). Again, the percentage of young in the catch for all species pooled independently decreased at each of the six stations by amounts ranging from 5% to 50% of the 1992 values, although none of these decreases were significant. We suggest that the decrease in the number of young birds produced on the Flathead National Forest was caused both by the fact that fewer adult birds were breeding in 1993 and by the fact that those birds that did breed had poorer success than in 1992. We further suggest that the poor productivity in 1993 was caused by the cold rainy spring and summer that characterized 1993 throughout the northern Rocky Mountains. The overall productivity index (percentage of young in the catch) for all six stations in 1993 was only 24% which further suggests that 1993 was a very poor year for landbird productivity on the Flathead National Forest.

BACKGROUND AND INTRODUCTION

It is generally agreed that Earth's biosphere and its landbird populations are facing a growing number of global environmental threats of ever increasing severity, including accelerating habitat loss, global climate change, loss of stratospheric ozone, and widespread toxic pollution. Indeed, the human species seems to have embarked upon a global ecological experiment, the ramifications of which may include greater avian extinction rates and faster rates of avian range change than ever recorded in the fossil record. Already, populations of many landbird species, especially forest-inhabiting species that winter in the Neotropics, appear to be in serious decline. In response to these observations, the Neotropical Migratory Bird Conservation Program, "Partners in Flight" (PIF), was initiated in 1991. The Monitoring Working Group of PIF emphasized the need for a comprehensive program of avian monitoring. As one of the major cooperating agencies in PIF, the U.S.D.A. Forest Service defined its role in the program to include the establishment of long-term avian population monitoring programs on selected national forests using protocols developed by the Monitoring Working Group of PIF.

The system of national forests may provide one group of ideal locations for this large-scale long-term avian monitoring because they provide large areas of breeding habitat for neotropical migratory landbirds that are subject to varying management practices. Such areas are critically needed for effective monitoring studies, not only to serve as locations for monitoring the effects of large-scale or even global environmental processes, but also to serve as experimental

areas for monitoring the effects of relatively local land-use practices. Indeed, population and demographic data on the landbirds found in any given forest are crucial for aiding research and management efforts within the forest to protect and enhance the forest's avifauna and ecological integrity while allowing the forest to serve its multi-use purposes.

The existing population-trend data on Neotropical migrants, while suggesting severe and sometimes accelerating declines, provide no information on primary demographic parameters (productivity and survivorship) of these birds. Thus, these data provide no means for determining at what point(s) in the life cycles of these species problems are occurring, or to what extent the observed population trends are being driven by causal factors that affect birth rates or death rates or both. In particular, the large-scale avian monitoring programs in North America that provide only population-trend data have been unable to determine to what extent forest fragmentation and deforestation on the temperate breeding grounds, versus that on the tropical wintering grounds, are causes for declining populations of Neotropical migratory landbirds. Without critical data on productivity and survivorship, it will be extremely difficult, if not impossible, to identify effective management and conservation actions to reverse the current population declines.

In response to these needs, The Institute for Bird Populations established the Monitoring Avian Productivity and Survivorship (MAPS) program in 1989. MAPS is a cooperative effort among public agencies, private organizations, and individual bird banders in North America to operate a continent-wide network of constant-effort mist-netting and banding stations to provide long-term demographic data on landbirds. The design of the MAPS program was patterned to a large extent after the very successful British Constant Effort Sites (CES) Scheme that has been operated by the British Trust for Ornithology (BTO) since 1981. The MAPS program was endorsed in 1991 by both the Monitoring Working Group of PIF and the U.S. Bird Banding Laboratory, and a four-year pilot project (1992-1995) was approved by the U.S. Fish and Wildlife Service to evaluate its utility and effectiveness for monitoring changes in demographic parameters of landbirds.

Now in its fifth year, the MAPS program has expanded considerably from 17 stations in 1989, 38 stations in 1990, 65 stations in 1991, and 170 stations in 1992 to about 238 stations in 1993. The substantial growth of the program in 1992 was caused by the endorsement of the program by PIF and the subsequent involvement of various federal agencies, including the U.S.D.A. Forest Service, the National Park Service, the Department of the Navy, and the Department of the Army, in the PIF program. In 1993, for example, The Institute for Bird Populations was contracted to operate six MAPS stations on the Flathead National Forest in Region 1 and six stations in each of six national forests in Region 6.

The purpose of this report is to: (1) summarize the objectives of the MAPS program, both as a long-term, continent-wide program to monitor the demographic parameters of landbirds and as a more local effort to monitor population and demographic parameters of the landbirds present in individual national forests; (2) describe both the field and analytical methods used; (3) summarize the results of the operation of the MAPS program on the Flathead National Forest during the summer of 1993; and (4) compare the 1993 results with those obtained in 1992.

OBJECTIVES

The major objectives of the MAPS program are twofold. First, to provide long-term, large-scale population and demographic information on target landbird species that can be used to: (a) aid in establishing thresholds and trigger points to notify appropriate agencies and organizations of the need for research and/or management actions; (b) aid in identifying the stage(s) in the life cycles at which changes in population dynamics are taking place; and (c) assist in identifying causes of population changes. This objective is to be carried out on a very large scale, with the North American continent divided into eight functional regions. It is envisioned that the national parks, national forests, military installations, and other federal and state lands will provide one subset of sites for this large-scale program. The second objective is to provide smaller scale, but still long-term, population and demographic information on target landbirds in specific national forests, national parks, and military installations. In this vein it is expected that information from the MAPS program will be capable of aiding research and management efforts within the national forests, to protect and enhance the forest's avifauna and ecological integrity, while allowing the forest to serve its multi-use purposes.

The specific goals of the MAPS program are to provide, for a suite of target species that includes both Neotropical migrant and permanent resident species: (a) annual indices of adult population size and post-fledging productivity from data on the numbers and proportions of young and adult birds captured; (b) annual estimates of adult survivorship, adult population size, and recruitment into the adult population from capture-recapture data on adult birds (after three or four years of data have been collected); and (c) additional, independent annual indices of adult population size from point-count data gathered in the vicinity of the mist-netting and banding stations. These population and demographic indices and estimates will be used to determine annual changes and long-term trends in the population and demographic parameters of the target species, and to identify and describe interrelationships between the population and demographic parameters and various readily measured environmental variables. They will also be used to facilitate comparisons among data obtained from stations located in various habitats and in landscapes subjected to various management practices in order to provide information relating to the effects of habitat type and management practice on the population and demographic parameters of the target species.

METHODS

Field work

Three field biologist interns of The Institute for Bird Populations, Tasha MacIlveen, Nicole Perretta, and Jeff Jones, were recruited during March and April, 1993, and were trained by Institute biologists Eric (Zed) Ruhlen and Hillary Smith during an intensive four-week training period at The Nature Conservancy's Creighton Ranch Preserve in the southern San Joaquin Valley of California and at various MAPS stations on three national forests in Oregon and Washington during May 1993. These three interns, along with biologist Ruhlen, then arrived at the Flathead National Forest in early June and began re-establishing the six MAPS stations run there in 1992 and established two new MAPS stations on the Flathead Reservation of the Confederated Salish and Kootenai Tribes. Because of a death in his family, Jeff Jones was forced to leave the program in early June. Michael Willison, an experienced birder but

without banding experience, was recruited to take Jeff's place and arrived at Flathead in early July. Elly Jones, an experienced bander from Swan Lake, Montana, who helped with the MAPS stations on the Flathead National Forest in 1992, completed our field crew and served as a field biologist intern in 1993 at the Swan Oxbow and Sixmile Mountain stations. All banding, point-count, and vegetation description data collected on the Flathead National Forest and Flathead Reservation in 1993 were taken by these four field biologist interns under the supervision of Institute biologist Ruhlen.

Six MAPS stations were established on the Flathead National Forest in early June 1993. These stations were re-established exactly as they were set-up in 1992 and were located (from north to south) as follows: (1) the Coram Experimental Forest station located in the Coram Experimental Forest at about 4000' elevation on the Flathead National Forest about four miles north of Hungry Horse Reservoir; (2) the Hillary Meadow station located at about 3600' elevation on the Flathead National Forest just north of Hungry Horse Reservoir; (3) the Sixmile Mountain station located at about 3300' elevation just east of Swan Lake on the Flathead National Forest; (4) the Swan Oxbow station located at about 3090' elevation on The Nature Conservancy's Swan Oxbow Preserve just south of the Swan River National Wildlife Refuge and about two miles south of Swan Lake; (5) the Swan Research Natural Area station located in the Swan River Research Natural Area at about 3095' elevation on the Flathead National Forest about 4.5 miles south of Swan Lake; and (6) the Simpson Creek station located at about 4000' elevation on Plum Creek Timber Company property about five miles north of Condon on Road 901. A summary of the major habitat types found at each of these stations and a summary of the 1992 operation of these six stations is presented in Table 1.

Ten net locations at each of the six stations that were operated in 1992 were re-established without difficulty in 1993 at the exact locations of the previous year. One 12-m, 30-mm-mesh 4-tier mist net was erected at each net site on each day of operation. The ten nets at each station were operated for six morning hours per day (beginning at about local sunrise) and for one day in each of the eight consecutive 10-day periods between June 10 and August 28. Because of logistical considerations (persistent rainfall combined with problems with the interns' automobiles), the initial operation of the Coram Experimental Forest and Hillary Meadow stations was delayed by about two weeks. All of the appropriate data were collected at these two stations, however, and the timing was back on schedule by early July. Otherwise, the operation of all stations occurred on schedule in each of the eight 10-day periods, an excellent record considering the weather conditions that prevailed in northwestern Montana in early summer.

All birds captured during the course of the study were identified to species, age, and sex and were banded with U.S. Fish and Wildlife Service (now, National Biological Survey) numbered aluminum bands. The following data were taken on all birds captured, including recaptures: capture code (i.e., newly banded, recaptured, band changed, not banded), band number, species, age, how aged, sex (if possible), how sexed (if applicable), extent of skull pneumatization, breeding condition of adults (i.e., presence or absence of a cloacal protuberance or brood patch), extent of juvenal plumage in young birds, extent of body and flight-feather molt, extent of primary-feather wear, fat class, wing chord, weight, date and time of capture, station, and net site. All data were taken according to standardized guidelines using standardized codes and were recorded on standardized forms provided by the MAPS program.

The locations of each of the nine point counts used in 1992 and the routes used to get to the points were re-established and flagged in 1993 at each of the six stations at exactly the same locations as in the previous year. These routes allowed the points to be censused in a specified sequence that minimized the travel time and amount of disturbance caused when approaching the points. Standardized 10-minute point counts were conducted three times at each of the nine points at each station, once during each of the first three 10-day periods of the season. The counting of the first point on each census day began at about local sunrise and the entire array of nine point counts took about two and one-half to three hours to complete. The starting point for conducting the counts on subsequent replications was varied so that each point was counted, on average, at about the same time of morning.

All adult birds seen or heard for unlimited distances from each point were tallied, although individuals thought to have been counted already at a previous point were indicated as such by an "x" placed over the tally mark. Individuals first encountered less than 50 meters from the point were tallied separately from individuals first encountered farther than 50 meters from the point, and all flyovers (regardless of distance from the point) were tallied separately. All data were recorded on standardized data forms provided by the MAPS program.

Simple habitat maps were prepared for each of the five stations operated, and the major habitat types, as well as the locations of all structures, roads, trails, and streams, were marked on the maps. Semi-quantitative habitat descriptions were then prepared for each of the four major layers of vegetation (trees, sub-canopy, shrubs, ground cover) in each major habitat type identified at each station.

Data verification and analysis

The computer entry of all banding, point count, and habitat data was completed, through the use of specially-designed Banding, Point-Count, and Vegetation Data Input Systems, by John W. Shipman of Zoological Data Processing, Sorocco, New Mexico. The critical data for each banding record (banding code, band number, species, age, sex, date, time of capture, station, and net number) were proofed by hand against the raw data, and any computer-entry errors were corrected. All banding data were then run through a series of specially-designed computer verification programs as follows. First, the extent of skull pneumatization was compared to the species and age determinations and any discrepancies were noted and corrected. Next, the breeding condition (extent of cloacal protuberance and brood patch) was compared to the species, age, and sex determinations and any discrepancies were flagged and corrected. Then, the extent of body and flight-feather molt, the extent of primary-feather wear, and the extent of juvenal plumage were compared to the species and age determinations and any discrepancies were again flagged and corrected. Next, the entire database was sorted by species, band number, date, and code and unusual or suspicious band numbers were noted and corrected. Finally, the 1993 database was sorted by band number, date, and code and any discrepancies among species, age, or sex were flagged and corrected. The 1993 banding database was then appended to the 1992 database and the combined database was sorted by band number, date, and code and was subjected to a specially-designed multi-year verification program to detect any discrepancies between the two years among species, age, or sex for a given band number. Wing chord, weight, and any pertinent notes were used as supplementary information for the correct determination of species, age, and sex in all of these verification programs.

The proofed, verified, and corrected banding data from 1993 were then run through a series of specially-designed analysis programs that calculated the number of newly-banded and recaptured birds, the capture rates (per 600 net-hours) of individual adult and young birds, and the percentage of young in the catch for each species and all species pooled at each station, and for each species and all species pooled at all stations combined. Following the procedures pioneered by the British Trust for Ornithology (BTO) in their CES scheme, the capture rate of adult birds was used as an index of adult population size, and the capture rate of young birds and the proportion of young in the catch were used as indices of post-fledging productivity.

Upon completion of the 1993 analyses, the combined database was subjected to a series of analysis programs to calculate changes between 1992 and 1993 in the indices of adult population size and post-fledging productivity, and to determine the statistical significance of any changes that occurred. These year-to-year comparisons were made in a constant-effort manner, that is, by including capture data in these analyses only from those nets that were operated in both years and during those times that those nets were operated in both years. This was accomplished by thoroughly comparing the summary of effort forms, supplemented by information from the banders' daily journal, and by eliminating from the analysis those capture records that occurred in a given net in one year at a time when that net was not operated in the other year. Again following the lead of the BTO in their CES scheme, the significance of annual changes in the indices of adult population size or post-fledging productivity on the Flathead National Forest as a whole, was inferred statistically from confidence intervals calculated from standard errors of the mean percentage changes for species captured at several stations in the forest. The statistical significance of changes at a given station was inferred from a binomial test on the proportion of species at that station that increased or decreased.

The proofed and corrected 1993 point-count data were also run through a series of specially-designed analysis programs that calculated, for each species at each station, the total number of individual birds detected during the three replications of nine 10-minute point counts for: (1) birds detected at distances of less than 50 meters from the point (excluding flyovers), (2) birds detected at all distances from the point (excluding flyovers), and (3) flyovers (regardless of distance from the point). Comparisons were again made between the 1992 and 1993 data, but only for birds detected at all distances from the point excluding flyovers. In order to compare constant-effort point-count data, we only compared individuals detected from a given point if the point was censused comparably in the two years. Again, we inferred the statistical significance of forest-wide changes in the number of birds counted from confidence intervals calculated from standard errors of the mean percentage changes for species counted at several stations in the forest. The statistical significance of changes at a given station were again inferred from a binomial test on the proportion of species at that station that increased or decreased.

RESULTS

Constant-effort mist-netting and banding

A total of 2,672.5 net-hours were accumulated at the six MAPS stations operated on Flathead National Forest in 1993 (Table 1). Data from 2,363.5 of these net-hours could be directly compared with 1992 data in a constant-effort manner. In order to facilitate comparison with the 1992 report, Tables 2 through 5 present the total data for 1993, while Tables 6 through 9 present

changes between 1992 and 1993 for constant-effort data.

A summary of the numbers of newly-banded, unbanded, and recaptured birds is presented for each species and for all species pooled at each of the six stations operated in 1993 in Table 2 and for all stations combined in Table 5. A total of 494 birds were banded at the six stations combined in 1993 and various individuals were recaptured a total of 156 times. In addition, 47 birds (mostly hummingbirds) were captured but were released unbanded; thus, a total of 697 captures were recorded in 1993, down considerably from the 915 captures recorded during the summer of 1992. Newly-banded birds were down the most compared to 1992 when 751 birds were banded, but recaptures were up slightly compared to 1992 when 143 recaptures were recorded. This was expected because a number of birds newly-banded in 1992 were recorded in 1993 as recaptures.

The greatest number of total captures was recorded at Sixmile Mountain (151), Hillary Meadow (145), Swan RNA (134), and Swan Oxbow (126), while substantially fewer captures were recorded at Simpson Creek (85) and Coram EF (56). Similarly, the highest species richness occurred at Swan Oxbow (25 species), Swan RNA (24), Hillary Meadow (23), and Sixmile Mountain (22), while substantially lower species richness occurred at Simpson Creek (18) and Coram EF (12). The total number of captures at each of the six stations in 1993 was significantly correlated with the total number of captures at those stations in 1992 ($r = 0.943$, slope = 0.643, df = 4, $P < 0.01$) but were lower at each station in 1993. Species richness at each of the six stations in 1993 was also significantly correlated with species richness in 1992 ($r = 0.838$, slope = 0.610, df = 4, $P < 0.05$) but again tended to be lower in 1993. This suggests that the relative abundances and species richesses at the various stations on the Flathead National Forest are stable over time and that the MAPS program picks up this information well.

Overall, Swainson's Thrush was the most frequently captured species in 1993, followed in decreasing order by Common Yellowthroat, MacGillivray's Warbler, Black-capped Chickadee, and Pine Siskin. This ranking was exactly the same for newly-banded birds and total captures, which is not too surprising since newly-banded birds comprised 71% of the total captures. Interestingly, these same five species were also the five most frequently captured species in 1992 and their ranking in 1992 was identical to that in 1993 suggesting that the overall breeding bird community in the Flathead National Forest is surprisingly stable from year to year.

The capture rate (per 600 net-hours) of individual adult and young birds and the percentage of young in the catch are presented for each species and for all species pooled at each station in Table 3 and for all stations combined in Table 5. Data on the capture rate of adults suggest that the total adult population size of all species pooled varied substantially among the six stations by a factor of nearly three and was greatest at Sixmile Mountain (127.8 birds per 600 net-hours) and Swan RNA (121.4), substantially less at Hillary Meadow (106.7) and Swan Oxbow (99.1), and much less at Simpson Creek (64.8) and Coram EF (45.3). The capture rates of adults at the various stations in 1993 were significantly correlated with adult capture rates at these same stations in 1992 ($r = 0.919$, slope = 0.581, df = 4, $P < 0.01$) but generally were much lower than in 1992, thus confirming that the relative abundance of breeding birds at the various stations on the Flathead National Forest appeared to remain stable over the two years although a decrease in population size occurred in 1993. The habitats present in the vicinity of each of the stations (Table 1) provide no obvious explanation for the differences in adult population size between

stations, except that, as in 1992, the stations with the lowest total adult population sizes (Coram EF and Simpson Creek) had little or no meadow or riparian habitat associated with them.

Overall, the nine most abundant breeding species (in decreasing order) at the six Flathead MAPS stations (as determined by the number of adults captured per 600 net-hours) were Swainson's Thrush, MacGillivray's Warbler, Common Yellowthroat, Pine Siskin, Cedar Waxwing, Orange-crowned Warbler, Warbling Vireo, American Redstart, and Black-capped Chickadee. The two most abundant breeding species in decreasing order (and the only species captured at a rate greater than 6.0 adults per 600 net-hours) at Coram EF were Swainson's Thrush and Orange-crowned Warbler. The six most abundant breeding species (by this criterion) at Hillary Meadow were Swainson's Thrush, MacGillivray's Warbler, Cedar Waxwing, Orange-crowned Warbler, American Redstart, and Dusky Flycatcher. At Sixmile Mountain the six most abundant species were Swainson's Thrush, Pine Siskin, MacGillivray's Warbler, Western Tanager, Solitary Vireo, and Warbling Vireo. At Swan Oxbow the four most abundant species were Swainson's Thrush, Northern Waterthrush, Common Yellowthroat, and American Redstart. At Swan RNA these four species were Common Yellowthroat, Swainson's Thrush, Lincoln's Sparrow, and Pine Siskin. And finally, at Simpson Creek these three species were Swainson's Thrush, MacGillivray's Warbler, and Black-capped Chickadee. In general, the dominant species at each station in 1993 were quite similar to the dominant species in 1992.

With the exception of Swan RNA, the capture rate of young birds of all species combined at the various stations followed a rather similar sequence to the capture rate of adults: Sixmile Mountain, Hillary Meadow, Swan Oxbow, Swan RNA, Simpson Creek and Coram EF. Nevertheless, the capture rates of young at the various stations in 1993 were almost significantly correlated with the capture rates of young at these same stations in 1992 ($r = 0.803$, slope = 0.527, df = 4, P = 0.06) but generally were much lower than in 1992. This suggests that the relative abundance of young birds at the various stations on the Flathead National Forest appeared to remain rather stable over the two years although a substantial decrease in the number of young captured occurred in 1993. This decrease in the number of young was greatest at Swan RNA.

The index of productivity for all species pooled, as determined by the proportion of young in the catch, was highest at Hillary Meadow, Sixmile Mountain, and Swan Oxbow, lower at Simpson Creek, and lowest at Swan RNA and Coram EF. Productivity at the various stations in 1993 was not significantly correlated with the 1992 productivity index ($r = 0.420$, slope = 0.084, df = 4, P >> 0.10). Nor was any obvious relationship found among the various stations between productivity and adult population size ($r = 0.420$, slope = 0.084, df = 4, P >> 0.10) nor between productivity and any of the more obvious habitat characteristics of the stations. The overall proportion of young in the catch for all species pooled at all stations combined was 24% in 1993, substantially lower than the 34% productivity figure found for all species pooled at all stations combined in 1992. Thus, it appears that productivity was very low in 1993 on the Flathead National Forest, perhaps a result of the very cold wet weather that characterized the late spring and summer of 1993.

Specially-designed analytical programs were used to calculate, in a constant-effort manner, the changes from 1992 to 1993 in the indices of adult population size and post-fledging productivity for each species and for all species pooled at each station, and to calculate the significance of these changes for all six stations combined. The results of these analyses are shown

for capture rates of adults, capture rates of young, and proportion of young in the catch in Tables 6 through 8, respectively.

Table 6 shows that the capture rate of adult birds of all species pooled at the six stations combined on the Flathead National Forest decreased significantly ($P < 0.01$) by 23.0% from 726.3 birds per 600 net-hours (b/600nh) in 1992 to 559.2 b/600nh in 1993. Decreases were recorded for 28 out of 44 species ($P = 0.048$; binomial test). The decreases for six species were significant: Hammond's Flycatcher, Swainson's Thrush, Cedar Waxwing, Red-eyed Vireo, American Redstart, and Dark-eyed Junco. None of the 16 increasing species showed significant increases. Adult population sizes of all species pooled decreased at each of the six stations, although the decrease at only one station, Swan RNA, was significant ($P = 0.031$; binomial test).

Table 7 shows that the capture rate of young birds of all species pooled at the same six stations combined on the Flathead National Forest also decreased significantly ($P < 0.001$) by 55.9% from 370.5 b/600nh in 1992 to only 163.6 b/600nh in 1993. Decreases were recorded for 30 out of 37 species ($P < 0.001$; binomial test). The decreases for five species were significant or near significant: Black-capped Chickadee, Swainson's Thrush, Northern Waterthrush, MacGillivray's Warbler, and Pine Siskin. None of the five increasing species showed significant increases. The capture rate of young birds of all species pooled also decreased at each of the six stations, although the decreases at only two stations, Swan Oxbow and Swan RNA, were significant ($P = 0.025$ and $P < 0.001$, respectively; binomial test).

Table 8 indicates that the percentage of young in the catch (an index of productivity) for all species pooled for all stations combined decreased significantly ($P < 0.05$) from 33.8% in 1992 to 22.6% in 1993. Decreases were recorded for 21 of 34 species ($P = 0.115$; binomial test). The decreases for four species were significant or near-significant: Swainson's Thrush, Northern Waterthrush, MacGillivray's Warbler, and Dark-eyed Junco. None of the 6 increasing species showed significant increases. The percentage of young in the catch for all species pooled also decreased at each of the six stations, although none of the decreases were significant (binomial test)

Point counts

The relative abundance of breeding birds was independently determined for each species and for all species pooled at each station on the Flathead National Forest (Table 4) and for all stations combined (Table 5) from point-count data collected in the vicinity of the mist-netting stations. The indices of adult population size calculated from the point-count data, in general, appeared similar to the corresponding indices for adult population size derived from the mist-netting and banding data (Table 3). In order to test this hypothesis, we ran correlation analyses between the indices of relative abundance derived by the two methods: the capture rate of individual adults from mist-netting data and the number of individual adults detected at all distances (excluding flyovers) from point-count data. The results of these analyses indicated that, as in 1992, the two measures were significantly positively correlated with each other at all six stations: Coram EF -- $r = 0.90$, $df = 27$, $P < 0.001$; Hillary Meadow -- $r = 0.81$, $df = 45$, $P < 0.001$; Sixmile Mountain -- $r = 0.68$, $df = 30$, $P < 0.001$; Swan Oxbow -- $r = 0.61$, $df = 46$, $P < 0.001$; Swan RNA -- $r = 0.67$, $df = 52$, $P < 0.001$; and Simpson Creek -- $r = 0.73$, $df = 31$, $P < 0.001$. The mean correlation coefficient for the six stations in 1993 was 0.73, very similar to the mean correlation coefficient for the six stations in 1992 which was 0.76.

Table 9 presents a comparison between 1992 and 1993 for the 10-minute point-count data collected at each of the six stations operated in both years. These data indicate that the number of individual adult birds counted for all species pooled at all six stations combined increased by 16.3% from 1992 to 1993. The increase, however, was not quite statistically significant ($P < 0.10$). Increases were recorded in 49 of 83 species ($P = 0.062$; binomial test). Significant or near-significant increases, however, were recorded in only three species: Warbling Vireo, Red-eyed Vireo, and Townsend's Warbler. In contrast, significant or near-significant decreases were recorded in seven species: Downy Woodpecker, Willow Flycatcher, Mountain Bluebird, Swainson's Thrush, Solitary Vireo, Northern Waterthrush, and Song Sparrow. At the level of individual stations, the number of individual adult birds counted for all species pooled increased at each of the six stations, although the increase at only one station, Swan RNA, was significant ($P = 0.024$; binomial test).

DISCUSSION

Constant-effort mist-netting and banding results

Both the capture rate of adults of all species pooled and species richness at the six MAPS stations operated on the Flathead National Forest were significantly positively correlated between 1992 and 1993, suggesting that the relative abundances of the breeding birds on the Flathead National Forest tend to be rather stable over time but differ markedly between sites. Perhaps not unexpectedly, the highest breeding bird abundances and greatest species richnesses tended to be associated with stations that had considerable meadow or riparian habitat. The fact that these patterns were consistent in two consecutive years having notably different weather suggests that these patterns may be both real and robust and that the MAPS protocol is capable of revealing these patterns very well. Furthermore, the relative abundances of breeding adults of the various species within each station remained quite similar between 1992 and 1993, further suggesting that the structure of the breeding bird communities at the various stations may also be relatively stable over time.

Constant-effort data mist-netting and banding data from the MAPS program showed that the capture rate of adults birds of all species pooled at all six stations combined decreased significantly by 23.0% in 1993 as compared to 1992, while significant decreases were recorded in six individual species. Moreover, the capture rate of adults of all species pooled independently decreased at each of the six stations by amounts varying from 7.4% to 34.8%. This provides strong evidence that a substantial decrease in breeding bird densities occurred on the Flathead National Forest in 1993. Three possible causes for this decrease are: (1) low productivity in 1992; (2) low overwintering survivorship from 1992 to 1993; and (3) lack of recruitment of young in 1993. Although all three factors could have contributed to the 1993 decline in breeding adults, I suggest that a lack of recruitment could have been the primary factor. This lack of recruitment may have occurred because the very heavy and late-melting snowpack in 1993 prevented potential young recruits from establishing territories. Such a situation was documented in the Sierran subalpine during summers following El Nino (very heavy snowfall) winters (DeSante, D. F., 1990, *Am. Nat.* 136:429-445). Productivity on the Flathead in 1992, as indicated by the percentage of young in the catch, was only 34%, however, and suggests that low productivity in 1992 may also have contributed to the low numbers of breeding birds in 1993.

Constant-effort mist-netting and banding data from MAPS also showed that the capture rate of young birds of all species pooled decreased significantly by

55.9% in 1993 compared to 1992, while significant or near-significant decreases were recorded in five individual species. Again, the capture rates of young of all species pooled decreased at each of the six stations by amounts ranging from 30.0% to 70.0%. This provides strong evidence for a substantial decrease in the number of young produced in 1993. A portion of this decrease in the number of young produced was, of course, due to the reduced breeding population sizes of 1993. However, productivity itself, as indicated by the percentage of young in the catch, was also significantly reduced from 33.8% in 1992 to only 22.6% in 1993. This represents a 33.1% proportional decrease from 1992 to 1993. Thus the decrease in the number of young birds captured in 1993 compared to 1992 was caused both by the fact that 23% fewer birds bred in 1993 than 1992 and by the fact that these fewer birds had 33% poorer reproductive success in 1993 than in 1992. The poorer reproductive success in 1993 was probably caused by the very cold and wet spring and summer that probably decreased insect populations and other critical breeding resources and that may have directly adversely affected both the growth and development of young birds and the ability of adult birds to gather food for their young. Indeed, the overall productivity index for the Flathead National Forest in 1993, about 24% young, appears to be very low compared to other areas in 1992 and 1993 and suggests that 1993 may have been a very poor year for the production of young on the Flathead.

Point-count results

The high and consistent nature of the correlation between the index of breeding bird population size derived from mist-netting data and that derived from point-count data for all six of the stations on the Flathead National Forest indicates that the array of mist nets effectively sampled adult birds at these stations in proportion to their abundance as determined by point counts. This provides strong evidence to suggest that both methods are capable of providing reasonably accurate information on the relative population sizes of the breeding birds on the Flathead National Forest.

Of considerable interest, however, is the fact that constant-effort mist-netting and banding data indicated a significant 23.0% decrease in the breeding bird population size for all species pooled at all stations on the Flathead National Forest combined, while constant-effort point-count data indicated a near-significant 16.3% increase in the breeding bird population size for all species pooled at these same six stations combined. We suspect that this discrepancy was caused by the fact that the start of the 1993 breeding season was very much delayed compared to 1992 by a very heavy winter snowpack and a very late spring snowmelt. For most species, the amount of bird song peaks during the period of territorial establishment and mate acquisition and falls off during the incubation and, especially, the nestling and fledgling periods. The timing of point counts in 1993, a late year, probably corresponded to the peak in bird song. In 1992, a much earlier year, point counts very likely were conducted later in the breeding cycle of the birds, when singing was diminished, even though they were conducted at the same calendar time in both years. As a result, in 1993, the quantity of singing may have reached a maximum during the middle or latter part of the three 10-day periods in which point counts were conducted, while that maximum may have been reached much earlier in 1992 and singing may have been greatly reduced during the middle and latter parts of the 30-day point-count period. Moreover, if the late snowmelt of 1993 prevented potential recruits from establishing territories in 1993, more of these floating birds may have been present in the breeding bird community and may have caused increased amounts of territorial defense and singing in already established territory holders. This could further inflate the amount of singing recorded on

point counts and would cause an increase in the numbers of birds recorded on point counts in 1993 even if the singing season was not timed differently between 1992 and 1993. This suggest that breeding bird population size indices based on mist-netting and banding may better reflect actual population sizes than indices based on point counts, because the capture of breeding birds is spread over a longer period of time than the recording of point-count data.

Along these same lines, it is also of interest that the percentage changes in the number of individual adult birds of all species pooled between 1992 and 1993, as determined by the two methods, were extremely well correlated with each other for five of the six stations ($r = 0.97$, $df = 3$, $P < 0.01$). That is, the stations that showed the largest decreases in breeding bird population size as determined by constant-effort mist-netting and banding also showed the smallest increases in breeding bird population size as determined by point counts, and vice-versa. One station, however, Swan RNA, did not follow this pattern. It showed the largest decrease in breeding bird population size as determined by constant-effort mist-netting and banding (-34.8%) and the largest increase in breeding bird population size as determined by point counts (37.0%). We can offer no explanation for this discrepancy at Swan RNA.

Comparison with data from the Flathead Indian Reservation

Two new MAPS stations were established in 1993 on the Flathead Indian Reservation through funding from the Confederated Salish and Kootenai Tribes of the Flathead Indian Reservation. In order to provide comparative information on these stations, summaries of data for them are presented as follows: the locations and operation of these stations in Table 10; the numbers of newly banded, unbanded, and recaptured birds in Table 11; the capture rates of adult and young bird and the percentage of young in the catch in Table 12; and the numbers of individuals counted on point counts in Table 13. These data suggest that the breeding bird population sizes may have been somewhat greater at the two stations on the Indian Reservation (117.5 b/600nh) than on the six stations on the National Forest (94.1 b/600nh). This may well have been caused by the lower elevations of the stations on the Indian Reservation which in turn caused a substantially lighter snowpack and earlier snowmelt at the Indian Reservation stations. Alternatively, however, there may simply be more breeding birds at these lower elevation stations.

Productivity was also considerably higher at the Indian Reservation stations where the capture rate of young was 63.5 b/600nh and percentage of young in the catch was 35% than on the Forest stations where the capture rate of young was only 29.9 b/600nh and the percentage of young was only 24%. The higher productivity on the Indian Reservation than on the Forest was probably a result of a somewhat earlier breeding season and generally more favorable weather in the Flathead River Valley where the two Indian Reservation stations were located than in the Swan and Hungry Horse River Valleys where the six Forest stations were located. Alternatively, habitat characteristics that are relatively independent of weather characteristics may have influenced both the higher breeding bird population sizes and productivity indices at the Indian Reservation stations. Additional years of data should allow us to differentiate between these two hypotheses.

Evaluation of the MAPS program on the Flathead National Forest

The results of the first two years of the MAPS program on the Flathead National Forest suggest that sensitive and reliable information on the adult

population sizes and productivities of Flathead's landbirds can be obtained from the MAPS program. The data collected in 1992 and 1993 appear to be at least as extensive, accurate, and representative of the local area as the data obtained from any MAPS station in the Northwest, or for that matter, anywhere in North America. Thus, these data will be an extremely useful addition to the continent-wide MAPS program.

On a more local level, it appears that the MAPS data from the Flathead National Forest are revealing consistent and important trends in at least the population sizes of Flathead's birds. Indeed, the fact that relationships among the stations remained quite consistent over the two years suggests that the relationships are real. Moreover, the year-to-year changes also seem reasonable in light of the markedly different weather conditions that persisted during each year's breeding season. Thus, it appears that the MAPS program may be able to supply valuable local information on the population and demographic parameters of the birds of the Flathead National Forest in particular and western Montana in general. Because three years of data are necessary before adult survival probabilities can be estimated from capture-recapture models, no information is yet available on the effectiveness of the MAPS program regarding survivorship.

It should be pointed out that the MAPS program was not designed to be an inventory program. It will be necessary to conduct many more extensive point counts in many additional habitats and locations before an inventory of the avifauna of the Flathead National Forest or of western Montana can be considered to be complete. Such work, however, is currently being done by Dr. Richard Hutto of the University of Montana. His work can be expected to dove-tail nicely with the more intensive, annually repeated effort of the MAPS program, which will provide sensitive information on the year-to-year and longer-term changes in the population levels and productivities of the landbirds present at representative habitats and locations in the forest.

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Table 1. Summary of the 1993 MAPS program in Flathead National Forest.

				1993 operation		
Station				Total number of net-hours ¹	No. of Periods	Inclusive Dates
Name	Code	No.	Major Habitat Type			
Coram EF	CEFO	133	Mixed conifer and deciduous forest	450.0 (405.0)	8	6/28-8/13
Hillary Meadow	HIME	134	Wet meadow, open woodland, mixed conifer forest	455.5 (439.5)	8	6/28-8/15 ²
Sixmile Mtn.	SIMO	135	Open conifer forest, riparian	432.0 (379.0)	8	6/19-8/21
Swan Oxbow	SWOX	136	Riparian, grassy meadow, conifer forest	460.0 (340.0)	8	6/20-8/22
Swan RNA	SRNA	137	Wet meadow, grassy meadow, conifer forest	440.0 (365.0)	8	6/10-8/18
Simpson Creek	SICR	138	Open woodland, riparian, cedar-conifer forest	435.0 (435.0)	8	6/11-8/18
ALL STATIONS COMBINED				2672.5 (2363.5)	8	6/10-8/22

¹ Total net-hours in 1993. Net-hours in 1993 that could be compared in a constant-effort manner to 1992 are shown in parentheses.

Table 2. Capture summary for the six individual MAPS stations operated in Flathead National Forest in 1993. N = Newly Banded, U = Unbanded, R = Recaptures of banded birds.

Table 2. (cont.) Capture summary for the six individual MAPS stations operated in Flathead National Forest in 1993.
 N = Newly Banded, U = Unbanded, R = Recaptures of banded birds.

Species	Coram EF			Hillary Mdw.			Sixmile Mt.			Swan Oxbow			Swan RNA			Simpson Creek		
	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R	N	U	R
Northern Waterthrush				3						10		1	2		1	1		
MacGillivray's Warbler				16		6	13	2	2	3			2		3	14	1	10
Common Yellowthroat				4		5				16	1	4	33		20			
Wilson's Warbler				1						1						1		
Western Tanager							11		3				1					
Black-headed Grosbeak										2								
Lazuli Bunting										1								
Chipping Sparrow							1						1					
Fox Sparrow	1			3	1													
Song Sparrow				5		3				8		1	2	1	1			
Lincoln Sparrow				1	1	1							3	1	4			
Oregon Junco	2			8		1	1			5			2			1		
Cassin's Finch						1												
Pine Siskin							27	1	2	1			6					
ALL SPECIES	31	4	21	107	12	26	115	7	29	97	9	20	89	8	37	55	7	23
NUMBER OF SPECIES	9	4	4	21	5	11	21	3	11	24	5	9	22	5	10	16	4	2
TOTAL NUMBER OF SPECIES		12			23			22			25			24			18	

Table 3. Number of aged individual birds captured per 600 net-hours and percentages of young in the catch at six individual MAPS stations operated in Flathead National Forest in 1993.

Species	Coram EF			Hillary Meadow			Sixmile Mt.			Swan Oxbow			Swan RNA			Simpson Creek		
	Ad.	%	Yg.	Ad.	%	Yg.	Ad.	%	Yg.	Ad.	%	Yg.	Ad.	%	Yg.	Ad.	%	Yg.
Rufous Hummingbird							2.8	1.4	33									
Red-naped Sapsucker	1.3	0.0	0	2.6	0.0	0				2.6	0.0	0	1.4	0.0	0	1.4	1.4	50
Downy Woodpecker										1.3	1.3	50						
Hairy Woodpecker							1.4	0.0	0							0.0	1.4	100
Red-shafted Flicker																0.0	1.4	100
Pileated Woodpecker										0.0	1.3	100						
Willow Flycatcher													5.5	0.0	0			
Hammond's Flycatcher				1.3	0.0	0				5.2	0.0	0						
Dusky Flycatcher				6.6	0.0	0	4.2	0.0	0	0.0	1.3	100	1.4	0.0	0			
Western Flycatcher										1.3	0.0	0						
Gray Jay													5.5	0.0	0	1.4	2.8	67
Black-capped Chickadee	2.7	1.3	33	1.3	4.0	75	1.4	8.3	86	0.0	6.5	100	5.5	4.1	43	8.3	2.8	25
Mountain Chickadee							0.0	1.4	100									
Chest.-back. Chickadee							1.4	0.0	0							1.4	0.0	0
Red-breasted Nuthatch							0.0	1.4	100									
Brown Creeper							0.0	1.4	100									
Golden-crowned Kinglet	5.3	1.3	20	1.3	2.6	67							0.0	1.4	100	2.8	0.0	0
Ruby-crowned Kinglet				4.0	5.3	57												
Swainson's Thrush	18.7	4.0	18	23.7	0.0	0	27.8	5.6	17	18.3	2.6	13	10.9	0.0	0	23.4	2.8	11
American Robin	1.3	0.0	0							2.6	0.0	0	1.4	0.0	0			
Gray Catbird										2.6	0.0	0						
Cedar Waxwing				10.5	0.0	0	4.2	2.8	40	3.9	0.0	0	5.5	0.0	0			
Solitary Vireo							8.3	1.4	14				1.4	0.0	0			
Warbling Vireo	4.0	0.0	0	4.0	0.0	0	8.3	2.8	25	3.9	0.0	0				1.4	0.0	0
Red-eyed Vireo										1.3	0.0	0	4.1	0.0	0			
Orange-crowned Warbler	6.7	0.0	0	9.2	0.0	0	2.8	1.4	33				4.1	0.0	0			
Yellow Warbler										3.9	0.0	0						
Audubon's Warbler	1.3	0.0	0	1.3	1.3	50	1.4	2.8	67							1.4	0.0	0
Townsend's Warbler	1.3	0.0	0	0.0	4.0	100	0.0	1.4	100							1.4	0.0	0
American Redstart				6.6	4.0	38	1.4	0.0	0	10.4	1.3	11	1.4	1.4	50	0.0	1.4	100
Northern Waterthrush				2.6	1.3	33				11.7	1.3	10	2.7	0.0	0	0.0	1.4	100
MacGillivray's Warbler				19.8	4.0	17	19.4	1.4	7	2.6	1.3	33	4.1	1.4	25	20.7	4.1	17
Common Yellowthroat				2.6	4.0	60				11.7	10.4	47	43.6	10.9	20			
Wilson's Warbler				0.0	1.3	100				1.3	0.0	0				1.4	0.0	0
Western Tanager							11.1	5.6	33				1.4	0.0	0			

Table 3.(cont.) Number of aged individual birds captured per 600 net-hours and percentages of young in the catch at six individual MAPS stations operated in Flathead National Forest in 1993.

Species	Coram EF			Hillary Meadow			Sixmile Mt.			Swan Oxbow			Swan RNA			Simpson Creek		
	Ad.	Yg.	%	Ad.	Yg.	%	Ad.	Yg.	%	Ad.	Yg.	%	Ad.	Yg.	%	Ad.	Yg.	%
Black-headed Grosbeak										2.6	0.0	0						
Lazuli Bunting										1.3	0.0	0						
Chipping Sparrow							1.4	0.0	0				1.4	0.0	0			
Fox Sparrow	1.3	0.0	0	4.0	0.0	0												
Song Sparrow				2.6	4.0	60				5.2	5.2	50	2.7	0.0	0			
Lincoln Sparrow				1.3	1.3	50							8.2	0.0	0			
Oregon Junco	1.3	1.3	50	1.3	9.2	88	1.4	0.0	0	3.9	2.6	40	1.4	2.7	67			
Cassin's Finch							1.4	0.0	0									
Pine Siskin							27.8	9.7	26	1.3	0.0	0	8.2	0.0	0			
ALL SPECIES	45.3	8.0	15	106.7	46.1	30	127.8	48.6	28	99.1	35.2	26	121.4	21.8	15	64.8	19.3	23
NUMBER OF SPECIES	11	4		19	13		18	15		21	11		21	6		10	9	
TOTAL NUMBER OF SPECIES	11			21			22			24			22			14		

Table 4. Total numbers of individual birds detected during three replications of nine 10-minute point counts at six individual MAPS stations operated in Flathead National Forest in 1993.

Table 4. (cont.) Total numbers of individual birds detected during three replications of nine 10-minute point counts at six individual MAPS stations operated in Flathead National Forest in 1993.

Species	Coram EF		Hillary Meadow		Sixmile Mt.		Swan Oxbow		Swan RNA		Simpson Creek	
	<50m ¹	All ²										
Great Crested Flycat.	1	2			1							
Tree Swallow									3		8	
Violet-green Swallow											1	
N. Rough-wing. Swallow											2	
Bank Swallow											3	
Cliff Swallow									1			
Gray Jay					10					5	12	
Steller's Jay					1					2	8	
Common Raven	2		2	7		2			1	1	5	
Black-capped Chickadee	1	9	2	9				13		7	25	
Mountain Chickadee								3			1	
Chest.-back. Chickadee			5	10				1	3		1	
Red-breasted Nuthatch	4	17	3	17	1	2	11		2	18		2
Pygmy Nuthatch			1	2						2	27	16
Brown Creeper		2										
Winter Wren											2	
Golden-crowned Kinglet	4	8	5	11					4		2	
Ruby-crowned Kinglet	3	3	4	13			1		3	7		
Swainson's Thrush	18	66	14	68		10	38		4	26		
American Robin	2		3	12		1	4		1	15		
Varied Thrush	1			7		1	7		5			
Gray Catbird									2			
Cedar Waxwing			2	21	13	1	2	3	2	10	4	
Solitary Vireo						2	2					
Warbling Vireo	1	4	6	16		7	16		4	13		
Red-eyed Vireo				1			1		6	20		
Orange-crowned Warbler	6	11	14	30		3	3					
Nashville Warbler										1	1	
Yellow Warbler			2	2					3			
Audubon's Warbler	1	2	3	6		3	7		2		5	
Townsend's Warbler	6	13	3	19					5		42	
American Redstart			6	12				6	11			
Northern Waterthrush								1	5		1	
MacGillivray's Warbler	3	4	10	33	1	10	18		3	21		
Common Yellowthroat				4	12			12	33		28	63

Table 4. (cont.) Total numbers of individual birds detected during three replications of nine 10-minute point counts at six individual MAPS stations operated in Flathead National Forest in 1993.

Species	Coram EF			Hillary Meadow			Sixmile Mt.			Swan Oxbow			Swan RNA			Simpson Creek			
	<50m ¹	All ²	Fly-over																
Wilson's Warbler						2			1	2		2		1	3		3		
Western Tanager		2			1	4			3	16		6		5	20		2	10	1
Black-headed Grosbeak									1	6		5		3			6		
Spotted Towhee						1													
Chipping Sparrow					2	8						1		3	15		1	2	
Fox Sparrow					3	21						3		1	1		1	2	
Song Sparrow					1	7					2	8		9	32				
Lincoln Sparrow						2					1	1		7	15				
Oregon Junco	1	3		16	31	1	2	3		5	14		8	21		2	11		
Brown-headed Cowbird					2	2					1		2	7					
Pine Grosbeak	3	4										5							
Cassin's Finch	1					1													
Red Crossbill	2	3				6			4		1	1		2				1	
Pine Siskin	4	8	2	2	16	17	1	2	7	2	13	8	1	8	12		4	4	
Evening Grosbeak	3	3	1			3			5		2		1	1		1	2		
ALL SPECIES	63	178	10	128	462	38	57	153	24	61	320	31	124	515	48	82	327	12	
NUMBER OF SPECIES	17	28	4	32	46	7	20	25	6	18	45	13	33	49	15	22	32	7	
TOTAL NUMBER OF SPECIES	28			47			27			51			55			34			

¹ Includes only individuals detected within 50 meters of the point, excluding flyovers.

Includes all individuals detected from the point, excluding flyovers.

Table 5. Summary of combined results for all six Flathead National Forest MAPS stations operated in 1993.
 N = Newly Banded, U = Unbanded, R = Recaptures of banded birds.

Species	Birds captured			Birds/600 net hours			Total number of birds recorded on 10-min. point counts		
	N	U	R	Adults	Young	% Young	<50m ¹	All ²	FO ³
Common Loon							1		
Great Blue Heron							4	2	
Great Egret								2	
Green-winged Teal							2	2	
Mallard									1
Cinnamon Teal							2	2	
Common Merganser									2
Unidentified Duck							2		
Osprey							1	6	5
Red-tailed Hawk							1		
American Kestrel							1	1	
Ring-necked Pheasant							2	2	
Ruffed Grouse			3				1	5	
Spotted Sandpiper								4	
Common Snipe							1	8	
Barred Owl								1	
Short-eared Owl								1	
Northern Saw-whet Owl			1						
Common Nighthawk							1		1
Vaux's Swift									2
Calliope Hummingbird		1					2	2	
Rufous Hummingbird	2	21		0.4	0.2	33	11	11	2
Unidentified Hummingbird							1	1	2
Belted Kingfisher								6	1
Red-naped Sapsucker	7		2	1.6	0.2	13	9	27	
Williamson's Sapsucker							1	1	
Downy Woodpecker	3			0.2	0.2	50		1	
Hairy Woodpecker	2			0.2	0.2	50	2	8	1
Red-shafted Flicker	1			0.0	0.2	100	3	8	
Pileated Woodpecker	1			0.0	0.2	100	4	18	
Unidentified Woodpecker									1
Olive-sided Flycatcher								4	
Western Wood-Pewee								1	
Willow Flycatcher	4			0.9	0.0	0			

Table 5. (cont.) Summary of combined results for all six Flathead National Forest MAPS stations operated in 1993. N = Newly Banded, U = Unbanded, R = Recaptures of banded birds.

Species	Birds captured			Birds/600 net hours			Total number of birds recorded on 10-min. point counts		
	N	U	R	Adults	Young	% Young	<50m ¹		
							All ²	FO ³	
Hammond's Flycatcher	5	1	2	1.1	0.0	0	8	21	
Dusky Flycatcher	8		3	2.0	0.2	10	7	26	
Western Flycatcher	1			0.2	0.0	0	2	2	
Empidonax Flycatcher sp.		1							
Great Crested Flycatcher							1	3	
Tree Swallow									11
Violet-green Swallow									1
N. Rough-winged Swallow									2
Bank Swallow									3
Cliff Swallow									1
Gray Jay	5		2	1.1	0.4	29	14	39	1
Steller's Jay							2	9	
Common Raven							3	29	1
Black-capped Chickadee	35	3	4	3.1	4.4	59	11	60	
Mountain Chickadee	1			0.0	0.2	100			9
Chestnut-backed Chickadee			1	0.2	0.0	0	6	14	
Red-breasted Nuthatch	2			0.2	0.2	50	15	106	1
Pygmy Nuthatch							1	2	
Brown Creeper	1			0.0	0.2	100			2
Winter Wren	1			0.2	0.0	0			2
Golden-crowned Kinglet	11			1.6	0.9	36	13	36	
Ruby-crowned Kinglet	7			0.7	0.9	57	16	42	
Swainson's Thrush	79	5	55	20.4	2.5	11	65	311	
American Robin	3	1	2	0.9	0.0	0	10	60	4
Varied Thrush							1	26	
Gray Catbird	2			0.4	0.0	0			2
Cedar Waxwing	20		3	4.0	0.4	10	8	53	29
Solitary Vireo	7		4	1.6	0.2	13	2	2	
Warbling Vireo	18		2	3.6	0.4	11	31	84	
Red-eyed Vireo	4		1	0.9	0.0	0	11	44	
Orange-crowned Warbler	16		3	3.8	0.2	6	25	55	
Nashville Warbler							1	1	
Yellow Warbler	3			0.7	0.0	0	3	8	
Audubon's Warbler	6			0.7	0.7	50	9	25	1

Table 5. (cont.) Summary of combined results for all six Flathead National Forest MAPS stations operated in 1993. N = Newly Banded, U = Unbanded, R = Recaptures of banded birds.

Species	Birds captured			Birds/600 net hours			Total number of birds recorded on 10-min. point counts		
	N	U	R	Adults	Young	% Young	<50m ¹		
							All ²	FO ³	
Townsend's Warbler	5	1	2	0.4	0.9	67	15	103	
American Redstart	21		1	3.4	1.3	29	14	29	
Northern Waterthrush	16		2	2.9	0.7	19	2	6	
MacGillivray's Warbler	48	3	21	11.0	2.0	16	38	129	3
Common Yellowthroat	53	1	29	9.7	4.3	31	44	109	
Wilson's Warbler	3			0.4	0.2	33	2	12	
Western Tanager	12		3	2.0	0.9	31	11	58	
Black-headed Grosbeak	2			0.4	0.0	0	1	20	
Lazuli Bunting	1			0.2	0.0	0			
Spotted Towhee								1	
Chipping Sparrow	2			0.4	0.0	0	6	26	
Fox Sparrow	4	1		0.9	0.0	0	5	27	
Song Sparrow	15	1	5	1.8	1.6	47	12	47	
Lincoln Sparrow	4	2	5	1.6	0.2	13	8	18	
Oregon Junco	18		2	1.6	2.7	63	34	83	1
Brown-headed Cowbird							2	10	2
Pine Grosbeak								3	9
Cassin's Finch	1			0.2	0.0	0		2	
Red Crossbill								12	8
Pine Siskin	34	1	2	6.1	1.6	21	10	51	50
Evening Grosbeak							3	7	12
ALL SPECIES	494	47	156	94.1	29.9	24	515	1955	163
NUMBER OF SPECIES	44	16	23	41	31		54	73	28
TOTAL # OF SPECIES		49		45				82	

¹ Includes only individuals detected within 50 meters of the point, excluding flyovers.

² Includes all individuals detected from the point, excluding flyovers.

Table 6. Percent changes between 1992 and 1993 in the numbers of individual ADULT birds captured (per 600 net-hours) at six constant-effort MAPS stations operated in Flathead National Forest.

Species	Coram EF	Hillary Meadow	Sixmile Mountain	Swan Oxbow	Swan RNA	Simpson Creek	All six stations combined				
							n ¹	1992	1993	% change	SE ²
Sharp-shinned Hawk	-100.0						1	1.5	0.0	-100.0	3
Rufous Hummingbird			++++ ³				1	0.0	3.2	++++	
Red-naped Sapsucker	+100.0	-100.0		0.0	-100.0	0.0	5	11.1	7.6	-31.1	32.9
Downy Woodpecker	-100.0			0.0		-100.0	3	4.5	1.8	-60.9	35.7
Hairy Woodpecker		++++		-100.0			2	1.8	1.6	-10.3	179.4
Red-shafted Flicker					-100.0		1	1.6	0.0	-100.0	
Western Wood-Pewee											
Willow Flycatcher					+33.3		1	4.9	6.6	+33.3	
Hammond's Flycatcher	-100.0	0.0	-100.0	-75.0	-100.0	-100.0	6	19.3	3.1	-83.7	9.7 ***
Dusky Flycatcher		-44.4	-40.0		-100.0		3	23.5	11.6	-50.7	10.3
Empidonax flycatcher sp.						-100.0	1	1.4	0.0	-100.0	
Gray Jay					-20.0	++++	2	8.2	8.0	-3.2	33.6
Steller's Jay					-100.0		1	1.6	0.0	-100.0	
Black-capped Chickadee	0.0	-66.7	-50.0	-100.0	+300.0	+500.0	6	16.8	20.8	+23.8	66.1
Mountain Chickadee			++++				1	0.0	1.6	++++	
Chestnut-backed Chickadee				-100.0			2	1.6	1.4	-12.9	174.2
Red-breasted Nuthatch						++++					
Brown Creeper											
Winter Wren		-100.0				++++	2	1.4	1.4	+1.0	202.1
Golden-crowned Kinglet	++++	++++	-100.0		-100.0	0.0	5	7.6	10.1	+31.7	114.3
Ruby-crowned Kinglet		++++	-100.0		-100.0		3	3.2	1.4	-57.7	63.5
Swainson's Thrush	-53.6	-10.0	-38.7	-21.4	-11.1	-26.1	6	189.1	129.9	-31.3	7.1 ***
American Robin	++++			-33.3	0.0	-100.0	4	8.3	6.7	-20.0	27.8
Varied Thrush			-100.0			-100.0	2	3.0	0.0	-100.0	0.0
Gray Catbird				++++			1	0.0	3.5	++++	
Cedar Waxwing		-33.3	0.0	0.0	-20.0		4	29.7	22.6	-23.9	7.1 **
Solitary Vireo			+50.0		++++		2	6.3	11.1	+76.0	51.9
Warbling Vireo	++++	+50.0	+20.0	++++	-100.0	++++	6	15.6	23.2	+49.1	69.7
Red-eyed Vireo				-66.7	-62.5	-100.0	3	19.8	6.7	-66.2	4.2 ***
Orange-crowned Warbler	+50.0	+20.0	+100.0		++++		4	11.4	20.7	+82.3	66.9
Nashville Warbler											
Yellow Warbler				++++	-100.0		2	3.3	5.3	+61.0	322.0
Audubon's Warbler	++++	++++	-50.0				3	3.2	4.4	+39.9	134.9
Townsend's Warbler	0.0	-100.0				0.0	3	5.6	2.9	-48.8	37.5
American Redstart		-28.6	++++	-33.3	-80.0	-100.0	5	28.6	13.6	-52.5	17.8 **

Table 6. (cont.) Percent changes between 1992 and 1993 in the numbers of individual ADULT birds captured (per 600 net-hours) at six constant-effort MAPS stations operated in Flathead National Forest.

Species	Coram EF	Hillary Meadow	Sixmile Mountain	Swan Oxbow	Swan RNA	Simpson Creek	n ¹	All six stations combined			
								No. adults		% change	SE ²
Northern Waterthrush		0.0		+250.0	+100.0	-100.0	4	10.7	18.4	+72.3	88.0
MacGillivray's Warbler	-100.0	+16.7	+57.1	-50.0	-57.1	0.0	6	69.7	65.7	-5.7	16.9
Common Yellowthroat		-83.3		+100.0	-33.3		3	89.0	55.8	-37.3 ³	12.9
Wilson's Warbler						++++ ³	1	0.0	1.4	++++ ³	
Western Tanager			-38.5		++++		2	20.6	14.3	-30.5	16.0
Black-headed Grosbeak				-33.3	-100.0	-100.0	3	9.7	3.5	-63.6	25.1
Chipping Sparrow		-100.0	-50.0		++++		3	5.9	3.2	-45.3	46.3
Fox Sparrow	++++	++++					2	0.0	4.2	++++	
Song Sparrow		-33.3		0.0	-60.0		3	17.6	11.3	-35.8	19.1
Lincoln Sparrow		-50.0			-33.3		2	12.6	7.9	-36.9	5.7
Oregon Junco	0.0	-66.7	-66.7	-66.7	-100.0		5	18.9	6.2	-67.2	8.7 ***
Brown-headed Cowbird				-100.0			1	1.8	0.0	-100.0	
Cassin's Finch			-75.0				1	6.3	1.6	-75.0	
Pine Siskin		-100.0	+25.0	0.0	++++	-100.0	5	29.8	35.1	+17.5	12.7
ALL SPECIES POOLED	-23.7	-24.8	-18.9	-7.4	-34.8	-19.0	6	726.3	559.2	-23.0	4.2 ***
No. species that increased ⁴	6 (5)	8 (4)	9 (4)	5 (3)	8 (5)	6 (5)				16 (5)	
No. species that decreased ⁵	4 (3)	14 (5)	14 (6)	11 (3)	20 (11)	10 (9)				28 (5)	
No. species remained same	3	2	1	5	1	4				0	
TOTAL NUMBER OF SPECIES	13	24	24	21	29	20				44	
Proportion of increasing (decreasing) species	(0.308)	(0.583)	(0.583)	(0.524)	(0.690)	(0.500)				(0.636)	
Sig. of increase (decrease) ⁶	(0.133)	(0.271)	(0.271)	(0.500)	(0.031)	(0.589)				(0.048)	

¹ Number of stations at which % changes in the number of adults captured could be calculated.

² Standard error of the % change in the number of adult birds captured.

³ Increase indeterminate (infinite) because no adult was captured during the first year.

⁴ No. of species for which adults were captured in 1993 but not in 1992 are in parentheses.

⁵ No. of species for which adults were captured in 1992 but not in 1993 are in parentheses.

⁶ Statistical significance of the one-sided binomial test that the proportion of increasing (decreasing) species does not differ from 0.50.

* = P < 0.1; ** = P < 0.05; *** = P < 0.01; **** = P < 0.001.

Table 7. Percent changes between 1992 and 1993 in the numbers of individual YOUNG birds captured (per 600 net-hours) at six constant-effort MAPS stations operated in Flathead National Forest.

Species	Coram EF	Hillary Meadow	Sixmile Mountain	Swan Oxbow	Swan RNA	Simpson Creek	n ¹	All six stations combined			
								No. young		% change	SE ²
								1992	1993		
Sharp-shinned Hawk											
Rufous Hummingbird			++++ ³								
Red-naped Sapsucker		-100.0		-100.0		++++	1	0.0	1.6	++++ ³	
Downy Woodpecker				0.0			3	6.3	1.4	-78.0	33.1
Hairy Woodpecker				-100.0		++++	1	1.8	1.8	0.0	
Red-shafted Flicker						++++	2	3.5	1.4	-60.9	78.2
Western Wood-Pewee			-100.0			++++	1	0.0	1.4	++++	
Willow Flycatcher							1	1.6	0.0	-100.0	
Hammond's Flycatcher											
Dusky Flycatcher		-100.0	-100.0	++++			3	2.9	1.8	-40.1	89.9
Empidonax flycatcher sp.											
Gray Jay						++++	1	0.0	2.8	++++	
Steller's Jay											
Black-capped Chickadee	0.0	-57.1	-66.7	-40.0	-60.0	-60.0	6	49.2	21.7	-56.0	5.1 ****
Mountain Chickadee			++++				1	0.0	1.6	++++	
Chestnut-backed Chickadee			-100.0				1	1.6	0.0	-100.0	
Red-breasted Nuthatch		-100.0	-100.0		-100.0	-100.0	4	12.1	0.0	-100.0	0.0
Brown Creeper	-100.0	-100.0		-100.0			3	8.9	0.0	-100.0	0.0
Winter Wren											
Golden-crowned Kinglet	0.0	++++	-100.0		-75.0	-100.0	5	14.0	5.9	-58.1	28.3
Ruby-crowned Kinglet		-33.3					1	8.2	5.5	-33.3	
Swainson's Thrush	-80.0	-100.0	-42.9	-66.7		-81.8	5	57.9	15.3	-73.6	7.8 ****
American Robin					-100.0		1	1.6	0.0	-100.0	
Varied Thrush											
Gray Catbird											
Cedar Waxwing				-100.0			1	1.8	0.0	-100.0	
Solitary Vireo			0.0				1	1.6	1.6	0.0	
Warbling Vireo		-100.0	0.0				2	2.9	1.6	-46.3	49.7
Red-eyed Vireo				-100.0		-100.0	2	4.9	0.0	-100.0	0.0
Orange-crowned Warbler		-100.0	++++				2	6.8	1.6	-76.8	46.4
Nashville Warbler			-100.0				1	1.6	0.0	-100.0	
Yellow Warbler				-100.0	-100.0		2	6.8	0.0	-100.0	
Audubon's Warbler	-50.0	++++			-100.0		3	4.4	2.9	-32.6	55.7
Townsend's Warbler	0.0	0.0			-100.0		3	7.3	5.7	-22.5	27.0
American Redstart	-25.0		-100.0	-50.0	++++	4	14.0	7.1	-49.3	27.1	

Table 7. (cont.) Percent changes between 1992 and 1993 in the numbers of individual YOUNG birds captured (per 600 net-hours) at six constant-effort MAPS stations operated in Flathead National Forest.

Species	Coram EF	Hillary Meadow	Sixmile Mountain	Swan Oxbow	Swan RNA	Simpson Creek	n ¹	No. young			% change	SE ²
								1992	1993			
Northern Waterthrush		-66.7		-50.0	-100.0	++++ ³	4	10.9	4.5	-58.7	21.0 *	
MacGillivray's Warbler		0.0	-100.0	-100.0	-66.7	-25.0	5	22.6	9.9	-56.4	20.2 **	
Common Yellowthroat		+50.0		+150.0	-42.9		3	29.3	26.1	-10.9	39.5	
Wilson's Warbler		0.0			-100.0		2	3.0	1.4	-54.6	49.6	
Western Tanager			-50.0		-100.0		2	9.6	3.2	-67.1	22.5	
Black-headed Grosbeak			-100.0	-100.0		-100.0	3	6.3	0.0	-100.0	0.0	
Chipping Sparrow												
Fox Sparrow												
Song Sparrow		+200.0		+50.0			2	4.9	9.4	+91.9	60.4	
Lincoln Sparrow		++++			-100.0		2	3.3	1.4	-58.5	83.0	
Oregon Junco	++++	+600.0	-100.0	-100.0	-60.0	-100.0	6	16.1	14.3	-10.9	68.6	
Brown-headed Cowbird												
Cassin's Finch												
Pine Siskin		-100.0	-70.8		-100.0		3	42.6	11.1	-74.0	4.4 ***	
ALL SPECIES POOLED	-70.0	-30.0	-63.5	-53.1	-69.4	-46.2	6	370.5	163.5	-55.9	6.7 ****	
No. species increased ⁴	1(1)	5(2)	4(4)	3(1)	0(0)	6(6)					5(4)	
No. species decreased ⁵	2(1)	13(8)	13(9)	13(10)	16(10)	8(5)					30(10)	
No. species remained same	2	3	3	1	0	0					2	
TOTAL NUMBER OF SPECIES	5	21	20	17	16	14					37	
Proportion of increasing (decreasing) species	(0.400)	(0.619)	(0.650)	(0.765)	(1.000)	(0.571)					(0.811)	
Sig. of increase (decrease) ⁶	(0.500)	(0.192)	(0.132)	(0.025)	(<0.001)	(0.395)					(<0.001)	

¹ Number of stations at which % changes in the number of young captured could be calculated.

² Standard error of the % change in the number of young birds captured.

³ Increase indeterminate (infinite) because no young was captured the first year.

⁴ No. of species for which young were captured in 1993 but not in 1992 are in parentheses.

⁵ No. of species for which young were captured in 1992 but not in 1993 are in parentheses.

⁶ Statistical significance of the one-sided binomial test that the proportion of increasing (decreasing) species does not differ from 0.50.

* = P < 0.1; ** = P < 0.05; *** = P < 0.01; **** = P < 0.001.

Table 8. Absolute changes between 1992 and 1993 in the PERCENTAGE OF YOUNG in the catch at six constant-effort MAPS stations operated in Flathead National Forest.

Species	Coram EF	Hillary Meadow	Sixmile Mountain	Swan Oxbow	Swan RNA	Simpson Creek	All six stations combined				
							n ¹	Percent young			SE ²
								1992	1993	Change	
Sharp-shinned Hawk								--	--		
Rufous Hummingbird								--	--		
Red-naped Sapsucker		-66.7		-50.0		+50.0	3	49.9	15.3	-34.7	18.6
Downy Woodpecker				0.0			1	50.0	50.0	0.0	
Hairy Woodpecker								--	--		
Red-shafted Flicker								--	--		
Western Wood-Pewee			-100.0				1	100.0	--		
Willow Flycatcher					0.0		1	0.0	0.0	0.0	
Hammond's Flycatcher		0.0		0.0			2	0.0	0.0	0.0	
Dusky Flycatcher		-10.0	-16.7				2	12.7	0.0	-12.7	3.2
Empidonax flycatcher sp.								--	--		
Gray Jay					0.0		1	0.0	0.0	0.0	
Steller's Jay								--	--		
Black-capped Chickadee	0.0	+5.0	-6.8	+28.6	-50.0	-58.3	6	74.6	51.1	-23.5	13.0
Mountain Chickadee								--	--		
Chestnut-backed Chickadee			-100.0				1	100.0	0.0	-100.0	
Red-breasted Nuthatch						-100.0	1	100.0	0.0	-100.0	
Winter Wren								--	--		
Brown Creeper								--	--		
Golden-crowned Kinglet	-80.0				+33.3	-50.0	3	64.1	26.5	-37.7	17.0
Ruby-crowned Kinglet		-20.0					1	100.0	80.0	-20.0	
Swainson's Thrush	-16.1	-13.0	-1.0	-9.3	0.0	-21.8	6	23.4	10.5	-12.9	5.6 *
American Robin				0.0	-50.0		2	19.2	0.0	-19.2	23.6
Varied Thrush								--	--		
Gray Catbird								--	--		
Cedar Waxwing		0.0	0.0	-33.3	0.0		4	5.6	0.0	-5.6	6.6
Solitary Vireo			-5.7				1	20.0	14.3	-5.7	
Warbling Vireo		-33.3	-2.4				2	21.7	10.4	-11.3	9.0
Red-eyed Vireo				-40.0	0.0		2	16.1	0.0	-16.1	19.2
Orange-crowned Warbler	0.0	-50.0	+33.3				3	37.5	9.1	-28.4	17.5
Nashville Warbler								--	--		
Yellow Warbler				-100.0			1	100.0	0.0	-100.0	
Audubon's Warbler		-50.0	+50.0				2	46.3	50.0	+3.7	49.7
Townsend's Warbler	0.0	+40.0	0.0			0.0	4	50.4	66.5	+16.1	30.8
American Redstart			+1.1	-50.0	+21.4	+100.0	4	32.9	37.2	+4.3	12.2

Table 8. (cont.) Absolute changes between 1992 and 1993 in the PERCENTAGE OF YOUNG in the catch at six constant-effort MAPS stations operated in Flathead National Forest.

Species	Coram EF	Hillary Meadow	Sixmile Mountain	Swan Oxbow	Swan RNA	Simpson Creek	All six stations combined				
							n ¹	Percent young		SE ²	
								1992	1993		
Northern Waterthrush		-26.7		-37.5	-66.7	+100.0	4	50.6	19.7	-30.9	12.7 *
MacGillivray's Warbler		-2.4	-36.4	-20.0	-5.0	-4.4	5	25.3	13.1	-12.3	5.3 *
Common Yellowthroat		+45.7		+5.6	-2.8		3	24.8	31.8	+7.1	11.0
Wilson's Warbler		0.0					1	100.0	100.0	0.0	
Western Tanager			-3.5		-100.0		2	31.9	18.1	-13.7	15.2
Black-headed Grosbeak				-25.0			1	25.0	0.0	-25.0	
Chipping Sparrow			0.0				1	0.0 ³	0.0 ³	0.0	
Fox Sparrow							--	--	--		
Song Sparrow		+35.0		+10.0	0.0		3	21.7	45.4	+23.6	17.1
Lincoln Sparrow		+50.0			-25.0		2	20.7	14.7	-6.0	21.9
Oregon Junco	+50.0	+62.5	-25.0	-40.0	+28.6		5	43.7	69.8	+26.1	19.4
Brown-headed Cowbird							--	--	--		
Cassin's Finch			0.0				1	0.0	0.0	0.0	
Pine Siskin			-34.1	0.0	-100.0		3	60.4	24.0	-36.4	4.0 **
ALL SPECIES POOLED	-17.3	-1.6	-16.2	-14.1	-13.2	-8.0	6	33.8	22.6	-11.2	2.9 **
No. species increased ⁴	1	7	2	3	3	3				6	
No. species decreased ⁵	2	9	11(2)	10(1)	8(2)	5(1)				21(3)	
No. species remained same	3	3	4	4	6	1				7	
TOTAL NUMBER OF SPECIES	6	19	17	17	17	9				34	
Proportion of increasing (decreasing) species	(0.333)	(0.474)	(0.647)	(0.588)	(0.471)	(0.556)				(0.618)	
Sig. of increase (decrease) ⁶	(0.344)	(0.500)	(0.166)	(0.315)	(0.500)	(0.500)				(0.115)	

¹ Number of stations at which absolute changes in the percentage of young could be calculated.

² Standard error of the absolute change in the percentage of young.

³ Data not comparable between years due to an undefined value for percentage of young in either 1992 or 1993.

⁴ No. of species for which the percentage of young was 0.0 in 1993 but not in 1992 is in parentheses.

⁵ No. of species for which the percentage of young was 0.0 in 1992 but not in 1993 is in parentheses.

⁶ Statistical significance of the one-sided binomial test that the proportion of increasing (decreasing) species does not differ from 0.50.

* = P < 0.1; ** = P < 0.05; *** = P < 0.01; **** = P < 0.001.

Table 9. Percent changes between 1992 and 1993 in the number of individual ADULT birds counted during three replications of nine 10-minute point counts at each of six constant-effort MAPS stations in Flathead National Forest.

Species	Coram EF	Hillary Meadow	Sixmile Mountain	Swan Oxbow	Swan RNA	Simpson Creek	All six stations combined			
							n ¹	1992	1993	No. individ.
				++++ ³						% change
Common Loon							1	0	1	++++ ³
Great Blue Heron		-100.0			-20.0		2	6	4	-33.3
Green-winged Teal					0.0		1	2	2	0.0
Mallard					-100.0		1	4	0	-100.0
Cinnamon Teal					++++		1	0	2	++++
Bufflehead				-100.0			1	1	0	-100.0
Unidentified duck					++++		1	0	2	++++
Osprey			++++	++++	++++		3	0	6	++++
Red-tailed Hawk					++++		1	0	1	++++
American Kestrel						++++	1	0	1	++++
Ring-necked Pheasant		++++					1	0	2	++++
Ruffed Grouse						+++'+	1	0	5	++++
Spotted Sandpiper				0.0			1	4	4	0.0
Common Snipe		++++		++++	-50.0		3	2	7	+250.0
Western Screech Owl						-100.0	1	1	0	-100.0
Short-eared Owl					++++		1	0	1	++++
Common Nighthawk					++++		1	0	1	++++
Calliope Hummingbird		++++					1	0	2	++++
Rufous Hummingbird	++++	0.0		-100.0	+100.0	++++	5	5	11	+120.0
Unidentified hummingbird			++++				1	0	1	++++
Belted Kingfisher					+500.0		1	1	6	+500.0
Red-naped Sapsucker	+200.0	+400.0	0.0	-62.5	-33.3	-26.7	6	32	27	-15.6
Williamson's Sapsucker					++++		1	0	1	++++
Unidentified sapsucker	-100.0	-100.0			-100.0		3	3	0	-100.0
Downy Woodpecker	++++			-100.0		-100.0	3	11	1	-90.9
Hairy Woodpecker		++++		++++	++++		3	0	8	++++
Red-shafted Flicker	++++	++++	+++	-100.0	+100.0	-100.0	6	6	8	+33.3
Pileated Woodpecker	-100.0	+200.0			+40.0	-100.0	4	16	16	0.0
Olive-sided Flycatcher	-100.0	-100.0		++++	0.0		4	8	4	-50.0
Western Wood-peewee					++++		1	0	1	++++
Willow Flycatcher		-100.0		-100.0	-100.0	-100.0	3	11	0	-100.0
Hammond's Flycatcher	++++	-14.3	+++	+266.7	+100.0	-100.0	6	13	21	+61.5
Dusky Flycatcher	0.0	-85.7	+66.7	-85.7	+16.7	+200.0	6	41	26	-36.6
Western Flycatcher		-100.0	+++				2	1	2	+100.0
Great Crested Flycatcher	++++	+++					2	0	3	++++
Violet-green Swallow					-100.0		1	5	0	-100.0

Table 9. (cont.) Percent changes between 1992 and 1993 in the number of individual ADULT birds counted during three replications of nine 10-minute point counts at each of six constant-effort MAPS stations in Flathead National Forest.

Species	Coram EF	Hillary Meadow	Sixmile Mountain	Swan Oxbow	Swan RNA	Simpson Creek	All six stations combined				
							No. individ.		% change	SE ²	
							n ¹	1992	1993		
N. Rough-winged Swallow				-100.0			1	6	0	-100.0	
Gray Jay		+300.0			+500.0	++++ ³	3	4	37	+825.0	643.4
Steller's Jay		0.0			++++	-100.0	3	2	9	+350.0	601.6
American Crow				-100.0			1	1	0	-100.0	
Common Raven	-33.3	+100.0	++++	-16.7	++++	+100.0	6	15	28	+86.7	56.5
Black-capped Chickadee	+28.6	++++	-100.0	+85.7	+92.3	-75.0	6	53	60	+13.2	48.1
Mountain Chickadee		-100.0		++++	++++	++++	4	25	9	-64.0	49.7
Chestnut-backed Chickadee		++++		++++	-90.0		3	10	14	+40.0	204.2
Red-breasted Nuthatch	+183.3	-11.1	-15.4	+80.0	+58.8	-5.9	6	81	105	+29.6 ³	21.8 ⁴
Pygmy Nuthatch		++++					1	0	2	+++	--
Brown Creeper	-60.0						1	5	2	-60.0	
Winter Wren		-100.0			0.0		2	3	2	-33.3	44.4
Marsh Wren		-100.0					1	1	0	-100.0	
Golden-crowned Kinglet	+33.3	-26.7	-100.0	++++	+100.0	-26.7	6	39	36	-7.7	18.4
Ruby-crowned Kinglet	+200.0	+300.0	++++	0.0	+300.0	+42.9	6	20	41	+105.0	61.1
Mountain Bluebird	-100.0	-100.0	-100.0		-100.0		4	13	0	-100.0	0.0 ***
Swainson's Thrush	-17.5	-30.8	+26.7	+30.0	-12.5	-37.9	6	380	306	-19.5	8.0 *
American Robin	++++	+71.4	++++	-28.6	+145.5	-100.0	6	41	60	+46.3	53.3
Varied Thrush	++++	++++	-41.7	++++	+50.0	-100.0	6	17	26	+52.9	92.5
Gray Catbird				+100.0	-100.0		2	3	2	-33.3	88.9
Cedar Waxwing		+171.4	++++	+42.9	++++	-80.0	5	19	51	+168.4	143.7
Solitary Vireo	-100.0	-100.0	-60.0			-100.0	4	12	2	-83.3	14.0 ***
Warbling Vireo	+300.0	+30.0	+220.0	+116.7		+52.2	5	45	81	+80.0	27.7 **
Red-eyed Vireo		++++	0.0	+33.3	+40.0	+66.7	5	30	44	+46.7	10.9 **
Orange-crowned Warbler	-21.4	+285.7	++++		-100.0	++++	5	27	52	+92.6	109.6
Nashville Warbler					++++		1	0	1	+++	--
Yellow Warbler		+100.0	-100.0	-25.0	-100.0	+50.0	5	10	8	-20.0	28.8
Audubon's Warbler	0.0	-50.0	+600.0	-33.3	0.0	-57.1	6	30	25	-16.7	29.0
Townsend's Warbler	+225.0	+21.4	-100.0	+66.7	+200.0	+242.9	6	43	101	+134.9	51.9 **
American Redstart		+50.0		-15.4	-100.0	0.0	4	41	29	-29.3	33.9
Northern Waterthrush				-61.5	-75.0		2	17	6	-64.7	4.8 **
MacGillivray's Warbler	-55.6	-11.4	+100.0	+600.0	+50.0	+62.5	6	90	127	+41.1	33.1
Common Yellowthroat		-33.3		+312.5	+31.3	++++	4	74	109	+47.3	41.9
Wilson's Warbler		+100.0	++++	0.0	++++	++++	5	3	12	+300.0	293.4
Western Tanager	0.0	-20.0	+100.0	+50.0	+1900.0	+100.0	6	25	58	+132.0	87.3

Table 9. (cont.) Percent changes between 1992 and 1993 in the number of individual ADULT birds counted during three replications of nine 10-minute point counts at each of six constant-effort MAPS stations in Flathead National Forest.

Species	Coram EF	Hillary Meadow	Sixmile Mountain	Swan Oxbow	Swan RNA	Simpson Creek	n ¹	All six stations combined		
								-----	No. individ.	% change
Black-headed Grosbeak		-100.0	++++ ³	+66.7	-25.0	+100.0	5	11	20	+81.8 ³
Spotted Towhee		++++					1	0	1	++++
Chipping Sparrow	-100.0	-53.3	-100.0	-92.9	+650.0	-33.3	6	45	25	-44.4
Savannah Sparrow				-100.0			1	1	0	-100.0
Fox Sparrow		++++		+200.0	++++	++++	4	1	26	+2500.0
Song Sparrow		-61.1		-46.7	-36.0		3	83	47	-43.4
Lincoln Sparrow		-33.3		++++	+66.7		3	12	18	+50.0
Oregon Junco	-72.7	-17.1	-76.9	+75.0	+10.5	+120.0	6	91	81	-11.0
Red-winged Blackbird		-33.3	-100.0	-75.0	-100.0		1	1	0	-100.0
Brown-headed Cowbird		++++				-100.0	4	13	10	-23.1
Pine Grosbeak	++++						2	1	3	+200.0
Cassin's Finch	++++	++++	-100.0				3	1	2	+100.0
Red Crossbill	++++	++++		-87.5	++++	++++	5	8	12	+50.0
Pine Siskin	+33.3	+275.0	-83.3	+333.3	++++	0.0	6	29	50	+72.4
Evening Grosbeak	++++			++++	++++	++++	4	0	7	++++
ALL SPECIES POOLED	+5.3	+4.1	+7.0	+26.5	+37.0	+9.0	6	1655	1924	+16.3
No. species that increased ⁵	19(11)	29(15)	17(11)	30(13)	37(17)	22(11)				49(18)
No. species that decreased ⁶	11(5)	24(10)	13(8)	20(8)	17(9)	18(10)				31(11)
No. species remained same	3	2	2	3	4	2				3
TOTAL NUMBER OF SPECIES	33	55	32	53	58	42				83
Proportion of increasing (decreasing) species	0.576	0.436	0.531	0.566	0.638	0.524				0.590
Sig. of increase (decrease) ⁷	0.243	0.788	0.430	0.205	0.024	0.439				0.062

¹ Number of stations at which % changes in the number of adults counted could be calculated.

² Standard error of the % change in the number of adult birds counted.

³ Increase indeterminate (infinite) because no adult was counted the first year.

⁴ Standard error indeterminate because no adult was counted the first year.

⁵ No. of species for which adults were counted in 1993 but not in 1992 are in parentheses.

⁶ No. of species for which adults were counted in 1992 but not in 1993 are in parentheses.

⁷ Statistical significance of the one-sided binomial test that the proportion of increasing (decreasing) species does not differ from 0.50.

* = P < 0.1; ** = P < 0.05; *** = P < 0.01; **** = P < 0.001.

Table 10. Summary of the 1993 MAPS program on the Flathead Indian Reservation

				1993 operation		
Station				Total number of net-hours	No. of Periods	Inclusive Dates
Name	Code	No.	Major Habitat Types			
Crow Creek	CWCR	198	Riparian, ponderosa woodland, grassy meadow	450.0	8	6/18-8/19
Safe Harbor Marsh	SHMA	199	Freshwater marsh, conifer forest, low shrubs	428.3	8	6/17-8/19
ALL STATIONS COMBINED				878.3	8	6/17-8/19

Table 11. Capture summary for the two individual MAPS stations operated on the Flathead Indian Reservation in 1993.

N = Newly Banded, U = Unbanded, R = Recaptures of banded birds.

Species	Crow Creek			Safe Harbor Marsh			Both stations combined		
	N	U	R	N	U	R	N	U	R
American Kestrel			1						1
Calliope Hummingbird			1			5			6
Rufous Hummingbird			2			23			25
Downy Woodpecker	3					1			4
Western Wood-Pewee						2			2
Willow Flycatcher	4		1	12		2	16		3
Least Flycatcher				1			1		
Hammond's Flycatcher				3			3		
Dusky Flycatcher				2			2		
Western Flycatcher	5			2			7		
Empidonax Flycatcher sp.					1			1	
Black-capped Chickadee	19		1	16		8	35		9
Mountain Chickadee				2			2		
Red-breasted Nuthatch				8		1	8		1
Pygmy Nuthatch				1			1		
House Wren	11		5	1			12		5
Marsh Wren				11	1	2	11	1	2
Swainson's Thrush				6		2	6		2
American Robin	3	1		1			4		1
Gray Catbird	6						6		
Cedar Waxwing	1			7		1	8		1
Warbling Vireo				4		1	4		1
Orange-crowned Warbler				1			1		
Yellow Warbler	9	1	4				9	1	4
Townsend's Warbler				1			1		
Northern Waterthrush	1			1			2		
MacGillivray's Warbler	4			4		1	8		1
Common Yellowthroat		1		26	6	10	26	7	10
Wilson's Warbler	1			2	1		3		1
Western Tanager				5			5		
Lazuli Bunting	3		3				3		3
Spotted Towhee	2			2		1	4		1
Chipping Sparrow	1			2			3		
Song Sparrow	2	1		8	1	4	10	2	4
Lincoln's Sparrow	1						1		
Oregon Junco	1			1			2		
Red-winged Blackbird				1			1		
Brown-headed Cowbird	2		1	3		1	5		2
Cassin's Finch				2			2		
Red Crossbill				1			1		
Pine Siskin				31		1	31		1
ALL SPECIES POOLED	79	8	15	171	38	35	250	46	50
NUMBER OF SPECIES	19	7	6	33	7	13	37	10	16
TOTAL NUMBER OF SPECIES		23			36			41	

Table 12. Number of aged individual birds captured per 600 net-hours and percentages of young in the catch at two individual MAPS stations operated on the Flathead Indian Reservation in 1993.

Species	Crow Creek			Safe Harbor Marsh			Both stations combined		
	% Ad. Yg. Yg.			% Ad. Yg. Yg.			% Ad. Yg. Yg.		
Downy Woodpecker	4.6	0.0	0	0.0	1.4	100	2.2	0.7	25
Western Wood-Pewee				1.4	1.4	50	0.7	0.7	50
Willow Flycatcher	6.1	0.0	0	9.8	5.6	36	8.0	2.9	27
Least Flycatcher				1.4	0.0	0	0.7	0.0	0
Hammond's Flycatcher				2.8	1.4	33	1.5	0.7	33
Dusky Flycatcher				2.8	0.0	0	1.5	0.0	0
Western Flycatcher	3.0	4.6	60	2.8	0.0	0	2.9	2.2	43
Black-capped Chickadee	24.4	4.6	16	4.2	18.2	81	13.9	11.7	46
Mountain Chickadee				0.0	2.8	100	0.0	1.5	100
Red-breasted Nuthatch				7.0	4.2	38	3.6	2.2	38
Pygmy Nuthatch				1.4	0.0	0	0.7	0.0	0
House Wren	13.7	3.0	18	0.0	1.4	100	6.6	2.2	25
Marsh Wren				1.4	14.0	91	0.7	7.3	91
Swainson's Thrush				5.6	2.8	33	2.9	1.5	33
American Robin	3.0	1.5	33	1.4	0.0	0	2.2	0.7	25
Gray Catbird	6.1	3.0	33				2.9	1.5	33
Cedar Waxwing	1.5	0.0	0	7.0	1.4	17	4.4	0.7	14
Warbling Vireo				4.2	1.4	25	2.2	0.7	25
Orange-crowned Warbler				0.0	1.4	100	0.0	0.7	100
Yellow Warbler	12.2	1.5	11				5.8	0.7	11
Townsend's Warbler				1.4	0.0	0	0.7	0.0	0
Northern Waterthrush	1.5	0.0	0	0.0	1.4	100	0.7	0.7	50
MacGillivray's Warbler	0.0	4.6	100	4.2	1.4	25	2.2	2.9	57
Common Yellowthroat				18.2	19.6	52	9.5	10.2	52
Wilson's Warbler	0.0	1.5	100	1.4	1.4	50	0.7	1.5	67
Western Tanager				5.6	1.4	20	2.9	0.7	20
Lazuli Bunting	4.6	0.0	0				2.2	0.0	0
Spotted Towhee	1.5	1.5	50	1.4	1.4	50	1.5	1.5	50
Chipping Sparrow	0.0	1.5	100	2.8	0.0	0	1.5	0.7	33
Song Sparrow	0.0	3.0	100	8.4	2.8	25	4.4	2.9	40
Lincoln's Sparrow	1.5	0.0	0				0.7	0.0	0
Oregon Junco	0.0	1.5	100	1.4	0.0	0	0.7	0.7	50
Red-winged Blackbird				1.4	0.0	0	0.7	0.0	0
Brown-headed Cowbird	3.0	0.0	0	4.2	0.0	0	3.6	0.0	0
Cassin's Finch				2.8	0.0	0	1.5	0.0	0
Red Crossbill				1.4	0.0	0	0.7	0.0	0
Pine Siskin				37.8	5.6	13	19.7	2.9	13
ALL SPECIES POOLED	86.8	32.0	27	145.7	92.5	39	117.5	63.5	35
NUMBER OF SPECIES	14	12		28	21		35	27	
TOTAL NUMBER OF SPECIES		19		33				37	

Table 13. Total numbers of individual birds detected during three replications of nine 10-minute point counts at two individual MAPS stations operated on the Flathead Indian Reservation in 1993.

Species	Crow Creek			Safe Harbor Marsh			Both stations combined					
	<50m ¹		All ²	Fly-over	<50m ¹		All ²	Fly-over	<50m ¹		All ²	Fly-over
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pied-billed Grebe				4			3			3		4
Double-crested Cormorant			1									
Great Blue Heron				4								
Mallard	4	6	7		5	5			9	11	7	
Gadwall							2				2	
Redhead						6	1			6	1	
Common Merganser					1	1			1	1		
Unidentified Duck			1			2				3		
Osprey						4	4			4	4	
American Kestrel	1	5	1			1			1	6	1	
Prairie Falcon				1							1	
American Coot						1				1		
Killdeer							1				1	
Spotted Sandpiper			1							1		
Ring-billed Gull						2	5		2	5	2	
Unidentified Gull							2					
Caspian Tern				1							1	
Rock Dove		14		4						14	4	
Mourning Dove	5	24	5		2	16	2		7	40	7	
Common Nighthawk		4	2			1				5	2	
Calliope Hummingbird						2	4		2	4		
Rufous Hummingbird						2	8		2	8		
Belted Kingfisher				2							2	
Downy Woodpecker	1	2	1						1	2	1	
Hairy Woodpecker						2				2		
Red-shafted Flicker		8	1		1	6			1	14	1	
Olive-sided Flycatcher						1					1	
Western Wood-Pewee	2	10			6	24			8	34		
Willow Flycatcher	1	6				3			1	9		
Least Flycatcher					1	3			1	3		
Hammond's Flycatcher		2			2	10			2	12		
Dusky Flycatcher					2	3			2	3		
Western Flycatcher	3	4							3	4		
Empidonax Flycatcher sp.	1	1							1	1		
Eastern Kingbird	7	19	1						7	19	1	
Tree Swallow							1	5	6	1	5	6
N. Rough-winged Swallow	5	126	12					1		5	126	13
Bank Swallow				1								1
Cliff Swallow		2	51	10						2	51	10
Barn Swallow								1				1
Clark's Nutcracker		1	1								1	1
Black-billed Magpie		2	2								2	2
Common Raven						1	9			1	9	
Black-capped Chickadee	10	19			7	31			17	50		
Red-breasted Nuthatch					4	20	1		4	20		1
Pygmy Nuthatch		1	1		1	5			2	6		
House Wren		11	31						11	31		

Table 13 (cont.). Total numbers of individual birds detected during three replications of nine 10-minute point counts at two individual MAPS station operated on the Flathead Indian Reservation in 1993.

Species	Crow Creek			Safe Harbor Marsh			Both stations combined					
	<50m ¹		All ²	Fly-over	<50m ¹		All ²	Fly-over	<50m ¹		All ²	Fly-over
	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Marsh Wren					7	16			7	16		
Golden-crowned Kinglet		4								4		
Ruby-crowned Kinglet						1				1		
Swainson's Thrush		1			1	5			1	6		
American Robin	15	38	5		5	15	1		20	53	6	
Varied Thrush						1				1		
Gray Catbird	2	5							2	5		
Cedar Waxwing	4	24	3		1	11	3		5	35	6	
European Starling		6	1							6	1	
Warbling Vireo		1	1			1				2	1	
Red-eyed Vireo		1				2	1			3	1	
Orange-crowned Warbler						1				1		
Yellow Warbler	10	38							10	38		
Audubon's Warbler		1				2				3		
Townsend's Warbler						5				5		
American Redstart	1	2			1	1			2	3		
MacGillivray's Warbler	1	9			2	7			3	16		
Common Yellowthroat		1	1		3	13			3	14	1	
Wilson's Warbler		1								1		
Western Tanager					5	20	1		5	20	1	
Black-headed Grosbeak	2	3							2	3		
Lazuli Bunting	4	10							4	10		
Rufous-sided Towhee	3	18			1	4			4	22		
Chipping Sparrow	2	9			4	12			6	21		
Song Sparrow			1		1	6			1	6	1	
Oregon Junco	2	3				12			2	15		
Red-winged Blackbird						8				8		
Western Meadowlark	4	25							4	25		
Yellow-headed Blackbird					2	48	52		2	48	52	
Brown-headed Cowbird	6	27	11		6	22	3		12	49	14	
Bullock's Oriole		1								1		
Cassin's Finch					2	8			2	8		
Red Crossbill					4	18	8		4	18	8	
Pine Siskin	1	8	2		9	40	4		10	48	6	
American Goldfinch		6	3							6	3	
Evening Grosbeak						1					1	
ALL	111	581	84		94	458	95		205	1039	179	
NUMBER OF SPECIES	28	47	26		32	51	19		47	73	39	
TOTAL NUMBER OF SPECIES		53			57					83		

¹ Includes only individuals detected within 50 meters of the point, excluding flyovers.

² Includes all individuals detected from the point, excluding flyovers.